

Massachusetts Cardiac Quality Monitoring Program:

Lessons Learned and Future Directions

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Overview

- The Massachusetts experience in public reporting risk adjusted outcomes for invasive cardiac services
- Limitations of defining “Quality” in Cardiac Procedures through risk adjusted outcomes analysis
- Evidence for unintended consequences of public reporting
- Value of partnership between clinicians and public health stakeholders.

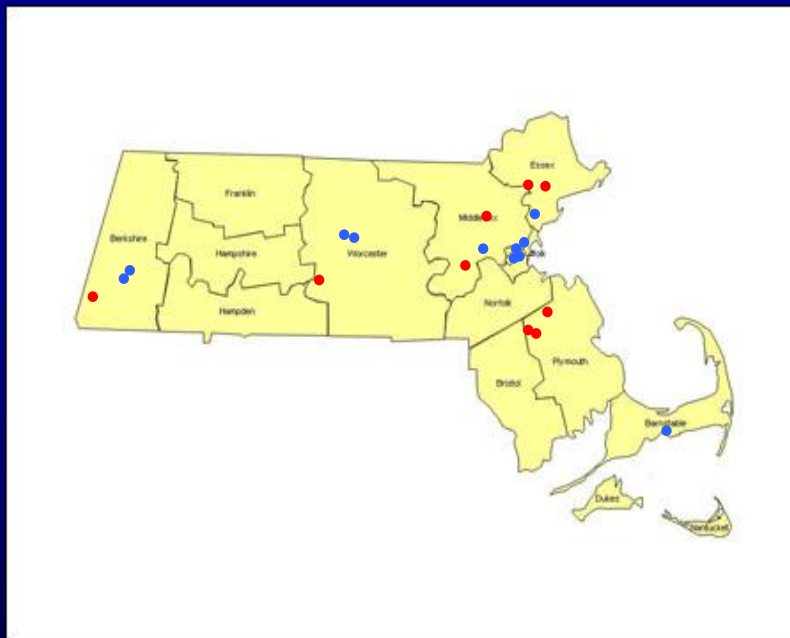


MA Cardiac Quality Registry

Massachusetts DPH implemented mandatory clinical outcomes registries for invasive cardiac services in 2002, focused on monitoring the performance of hospitals and physicians.

Patient Cohort

- 6 million residents
- 14 centers perform 7,200 open heart surgeries per year
- 22 centers perform 16,000 coronary intervention (stent) procedures per year



Dataset Features

- Standardized definitions (STS, NCDR)
- Rigorous adjudication and audits
- Linked outcomes to vital statistics and inpatient claims data



Collaborating Organizations

- **MA DPH:** MA Department of Public Health and Division of Healthcare Quality and Statistics regulate process
- **Mass-DAC:** MA Data Analysis Center is the coordinating and analytic center and holds the data outside of DPH. Funding from each hospital pro-rated based on volume.
- **MA-ACC:** MA Chapter of American College of Cardiology designated as sole “voice” of cardiology community. (MA-STS surgical equivalent)

Why CathPCI?

- High quality clinical datasets essential to adequately adjust for the great variability in PCI patient stability.
 - To date, *no* validation of use of administrative claims data for purposes of center specific risk adjustment in invasive cardiac services.
- Advisory panel (2001) recommended use of CathPCI as “best available” national clinical outcomes registry with standardized definitions
 - De-facto national standard
 - Evolves with clinical practice
 - Existing support infrastructure through NCDR meetings
- Over time, we have found that more clinical data is required for adequate risk adjustment and reporting.

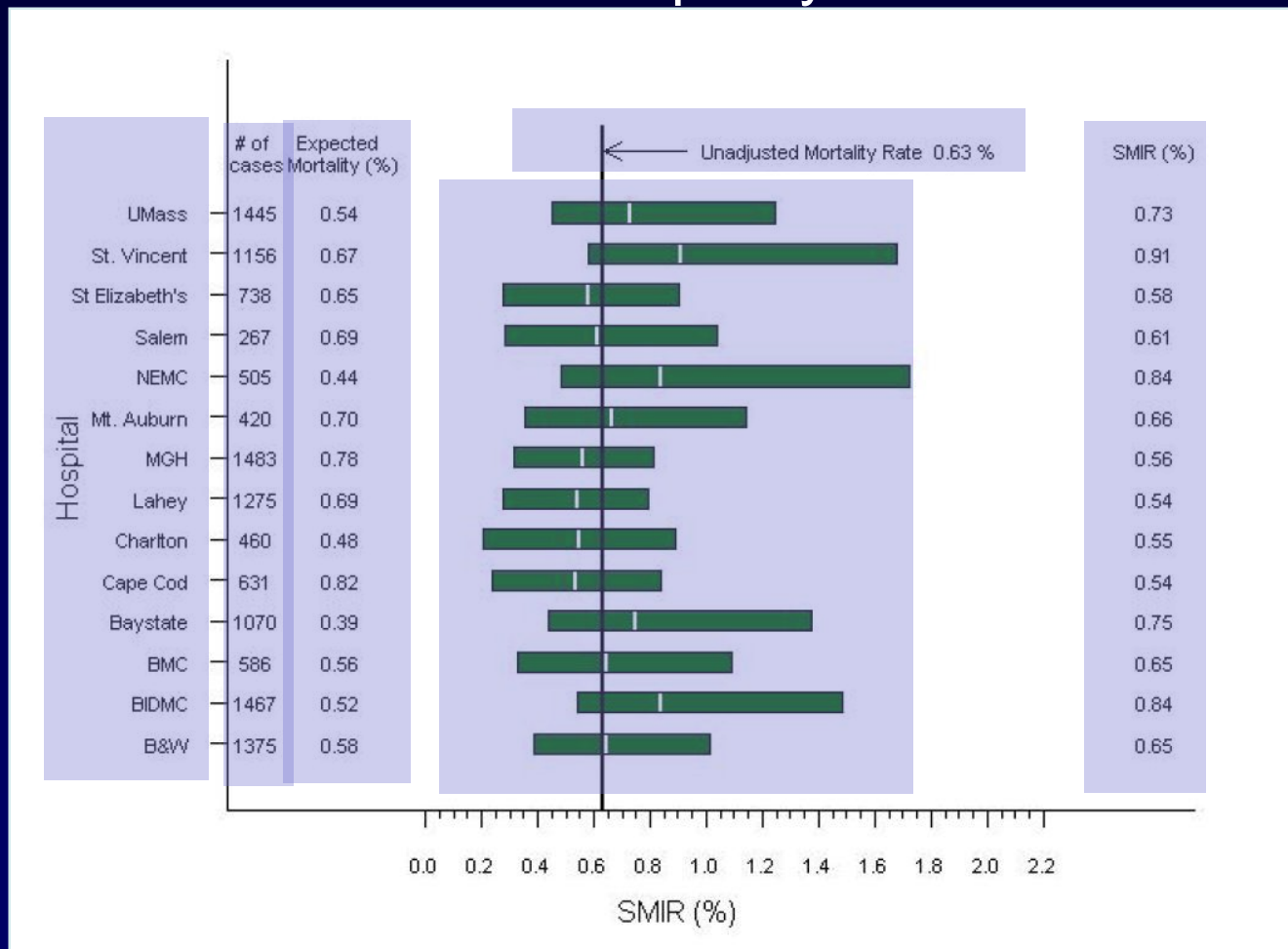
Mechanics of Process

- **Quarterly submissions of CathPCI dataset**
 - Resubmission of cleaned dataset w/in 6 months
 - Software vendors support “Mass-DAC” format
 - Supplemental variables: SSN, additional clinical data to improve model performance.
- **Critical Variable Review and Adjudication**
 - MD volunteers from throughout the state participate (~120 hrs/yr)
 - Review all critical covariates (shock) and outcomes
 - Special case level review for “compassionate use”
 - Additional panel for “Exceptional risk” cases
- **Result Review and Publication**
 - MD steering committee review results and MD-level analyses prior to publication



Interpreting Mass-DAC Reports

Mass-DAC uses “Standardized Mortality Incidence Rates” (SMIR) to compare hospital risk adjusted in-hospital all-cause mortality as a measure of overall quality.





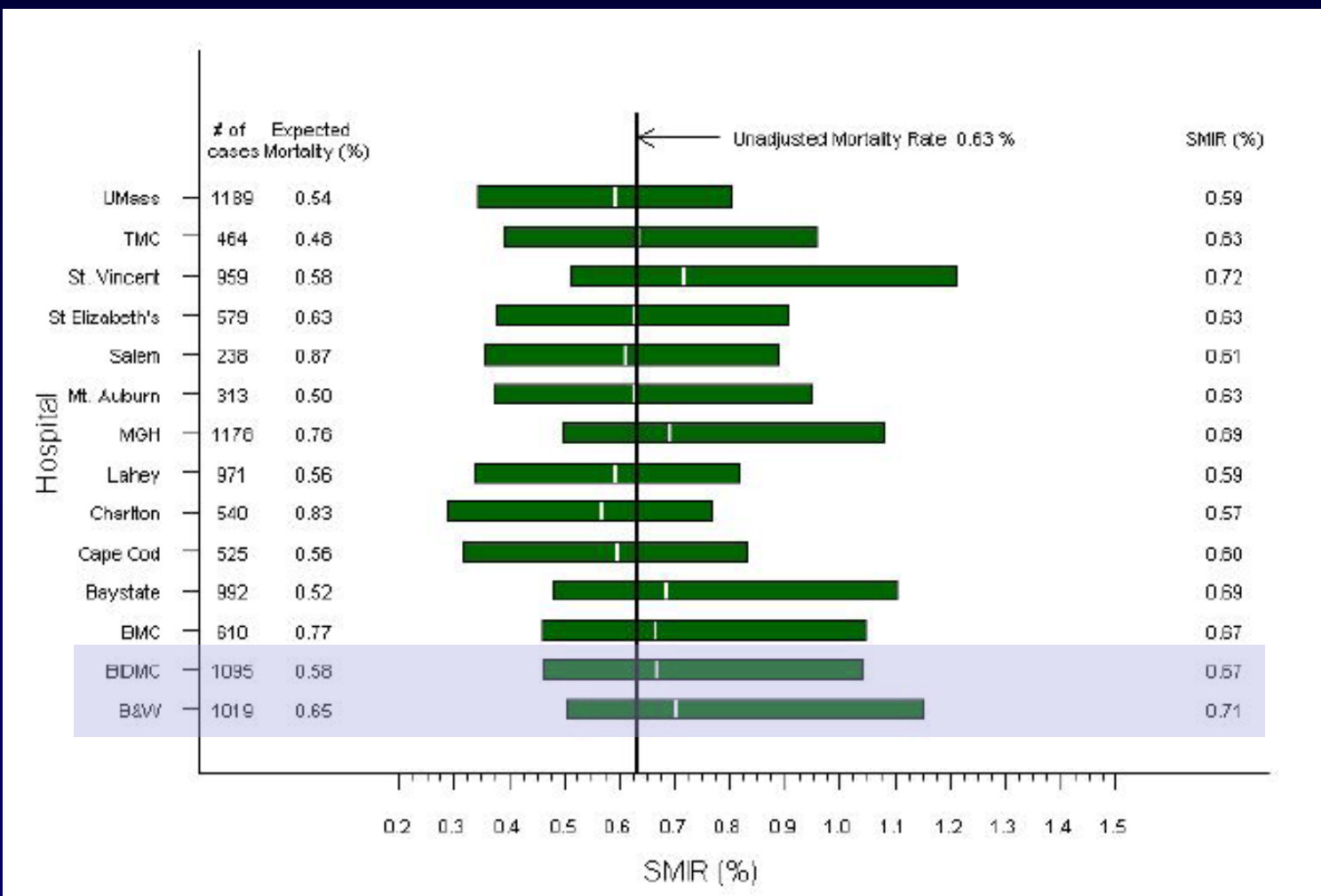
2008 No Shock and No STEMI Risk Model

Risk Factor	Prevalence (%)	Adjusted Relative Risk	95% Interval for the Adjusted Relative Risk
Mean Age (Years over 65)	0.08	1.04	(1.02, 1.07)
Renal Failure	6.50	2.83	(1.52, 4.67)
Diabetes	34.96	1.36	(0.80, 2.15)
Chronic Lung Disease	16.55	1.83	(1.02, 2.96)
Ejection Fraction < 30% (Ref $\geq 30\%$ or not measured)	3.10	3.27	(1.57, 5.83)
PCI Status (Ref = Elective)			
Urgent	60.24	6.38	(2.65, 14.61)
Emergency or Emergent Salvage	4.01	26.95	(9.18, 64.11)
Left Main Disease	7.11	2.00	(1.03, 3.43)
LAD >70% Stenosis	59.16	2.04	(1.10, 3.60)
Compassionate Use	0.13	6.66	(1.76, 16.29)
Between-Hospital Parameters		Mean	95% Interval
Between-Hospital Average log, μ		-8.02	(-8.85, -7.26)
Average Between-Hospital Variance in log, τ^2		0.0555	(0.0008012, 0.2868)



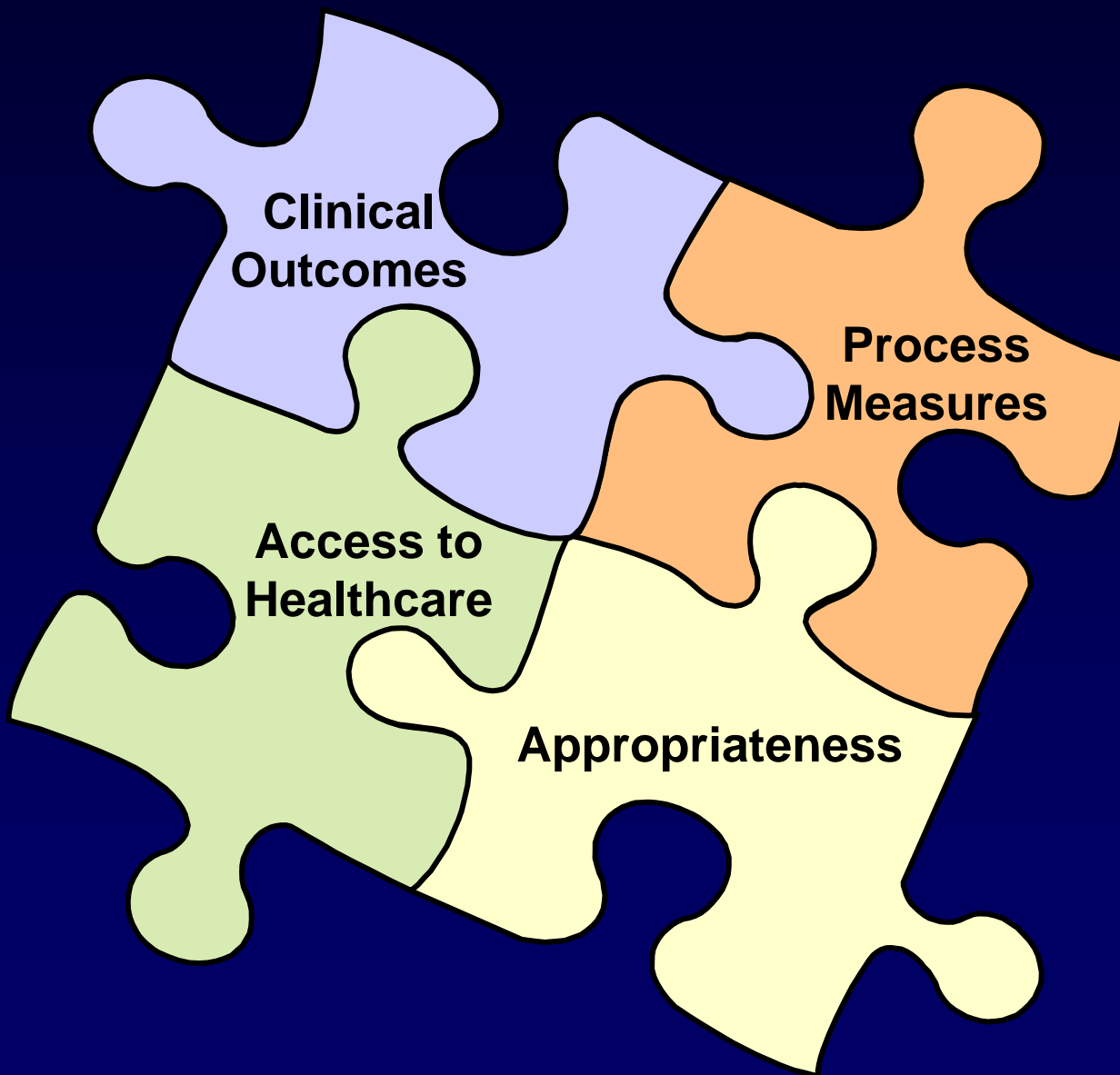
2008: No Shock and No STEMI

2008 results indicate all centers performed within expectations.



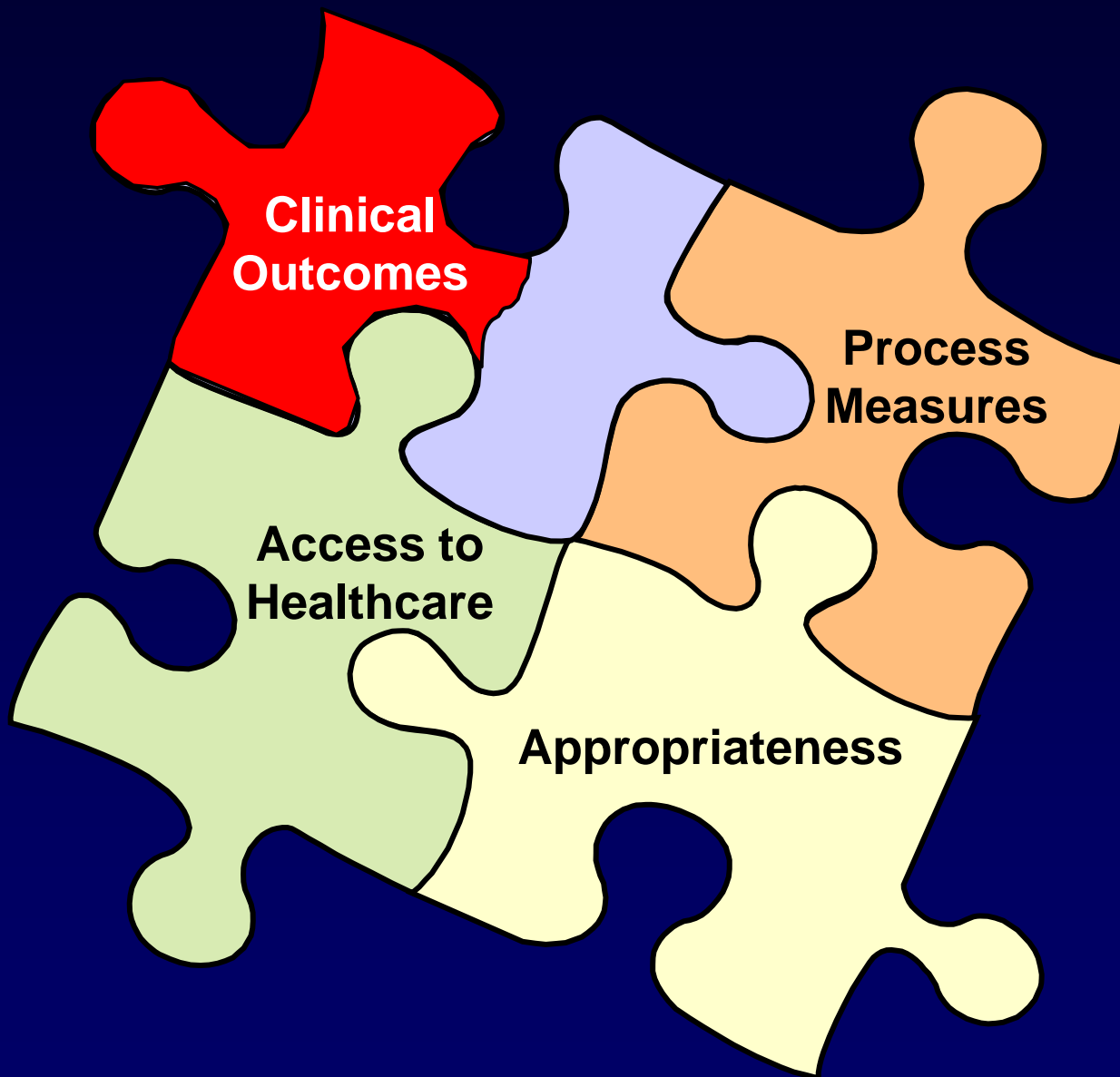


Cardiac Quality: The Big Picture





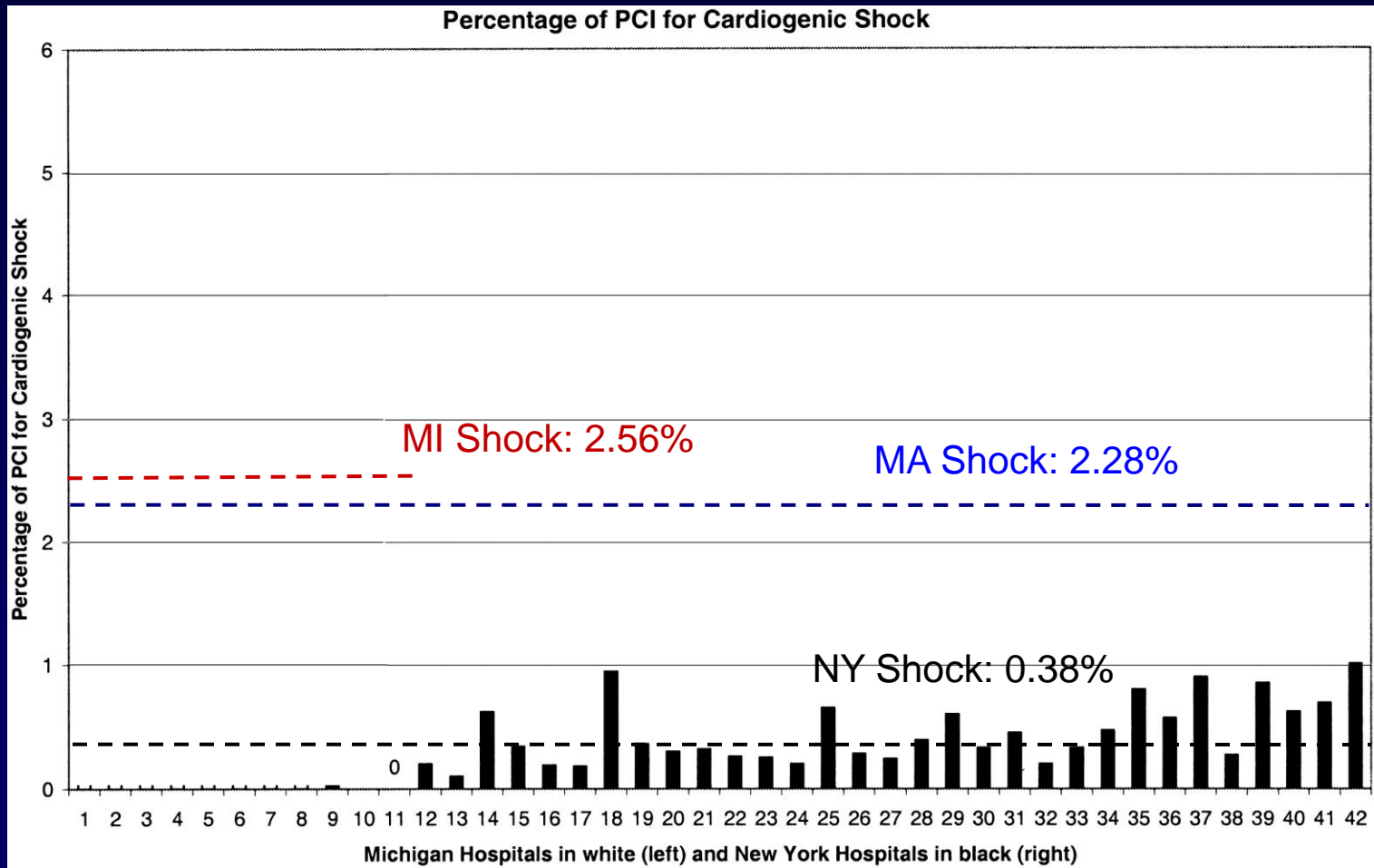
Cardiac Quality: The Big Picture





Risk Avoidance: Lessons from NY

Michigan, with no public reporting, was compared to NY State for PCI risk factors and outcomes.



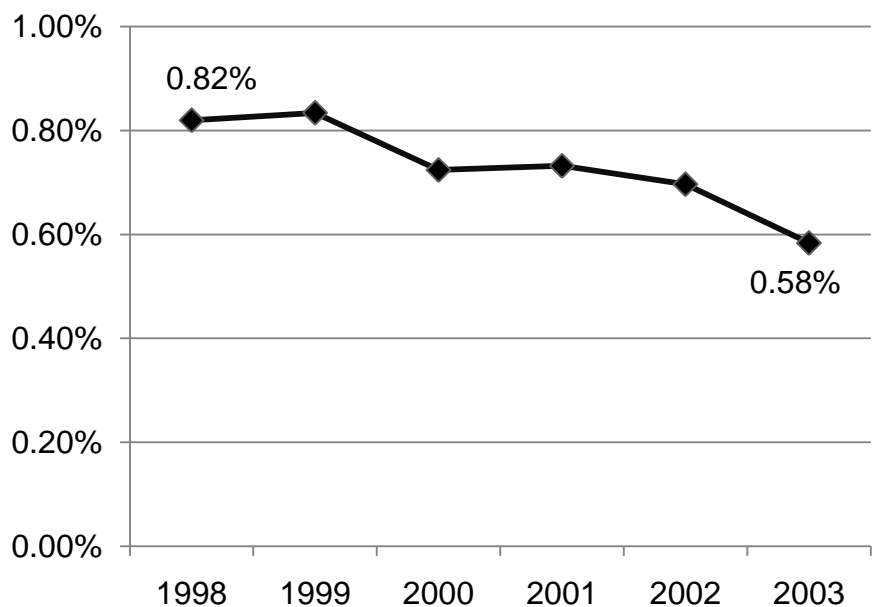
Adapted from: Moscucci et al. JACC 45(11). June 2005.



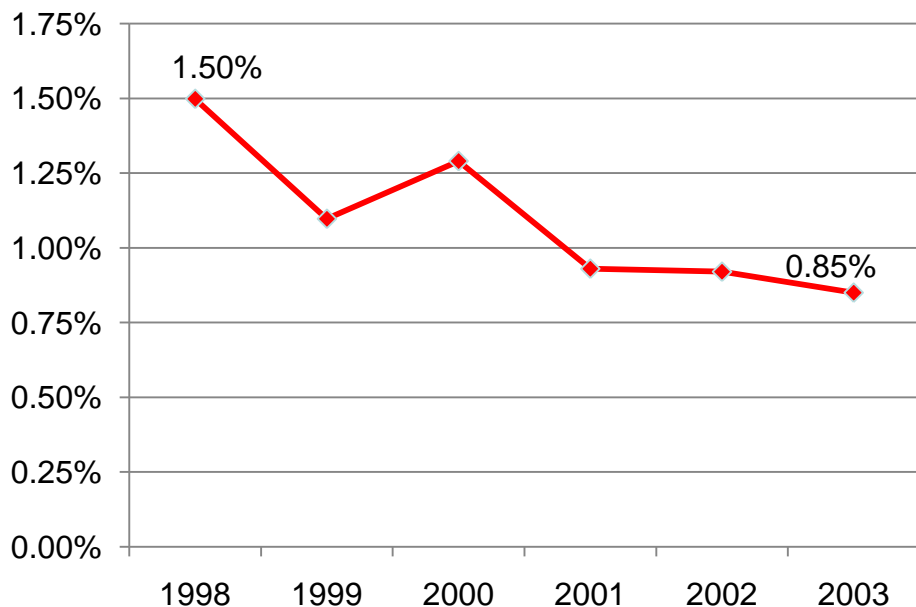
NY State PCI Mortality Trends

In-hospital mortality declined by 29% between 1998-2004, but was accompanied by a 43% reduction in the PCI treatment of cardiogenic shock.

NY PCI Mortality: 1998-2004



**PCI for Cardiogenic Shock
1998-2004**

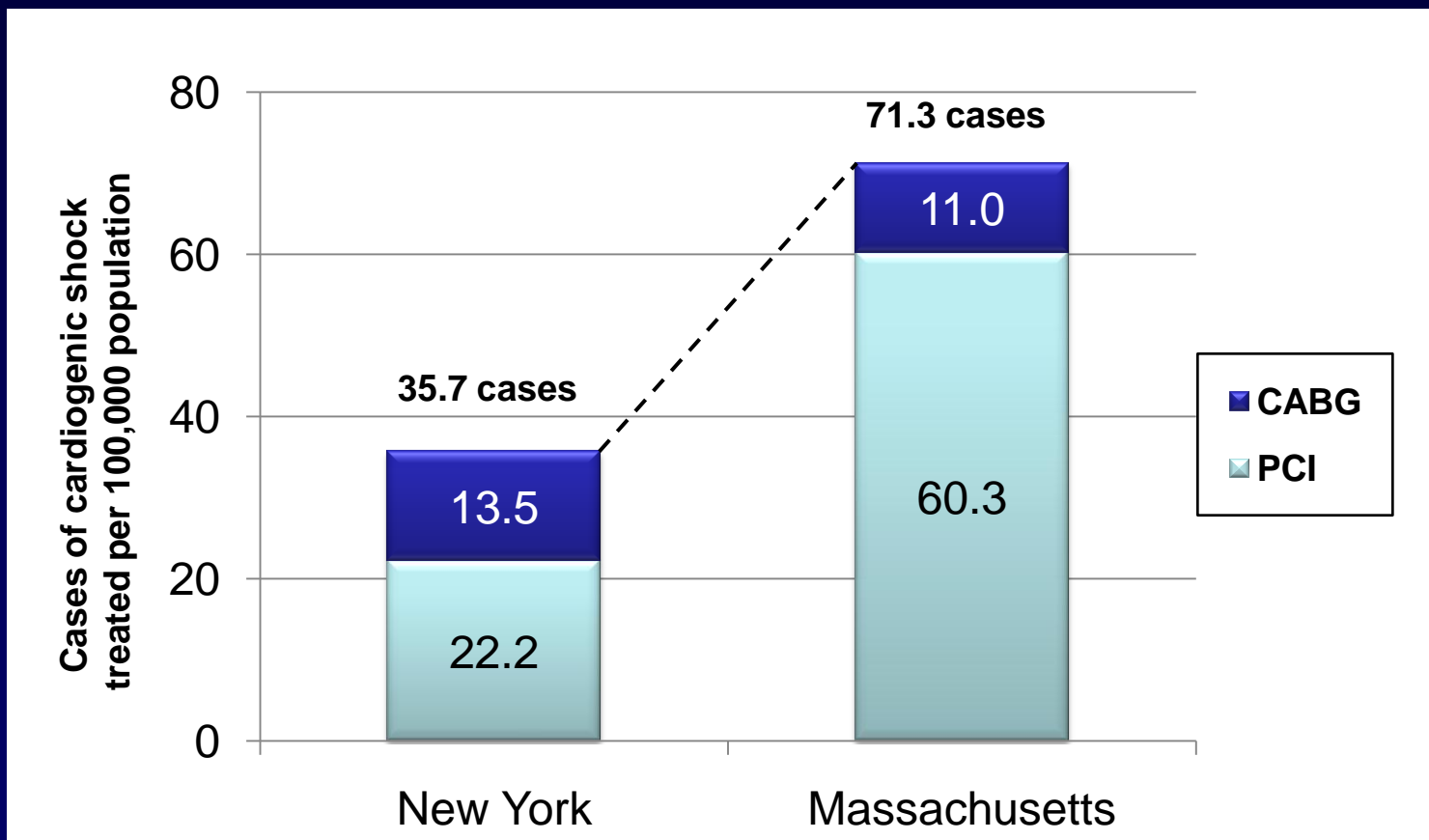


Adapted from: *Annual Angioplasty Quality Reports 1997-2004* available from:
www.health.state.ny.us/statistics/diseases/cardiovascular/



Comparing NY and MA

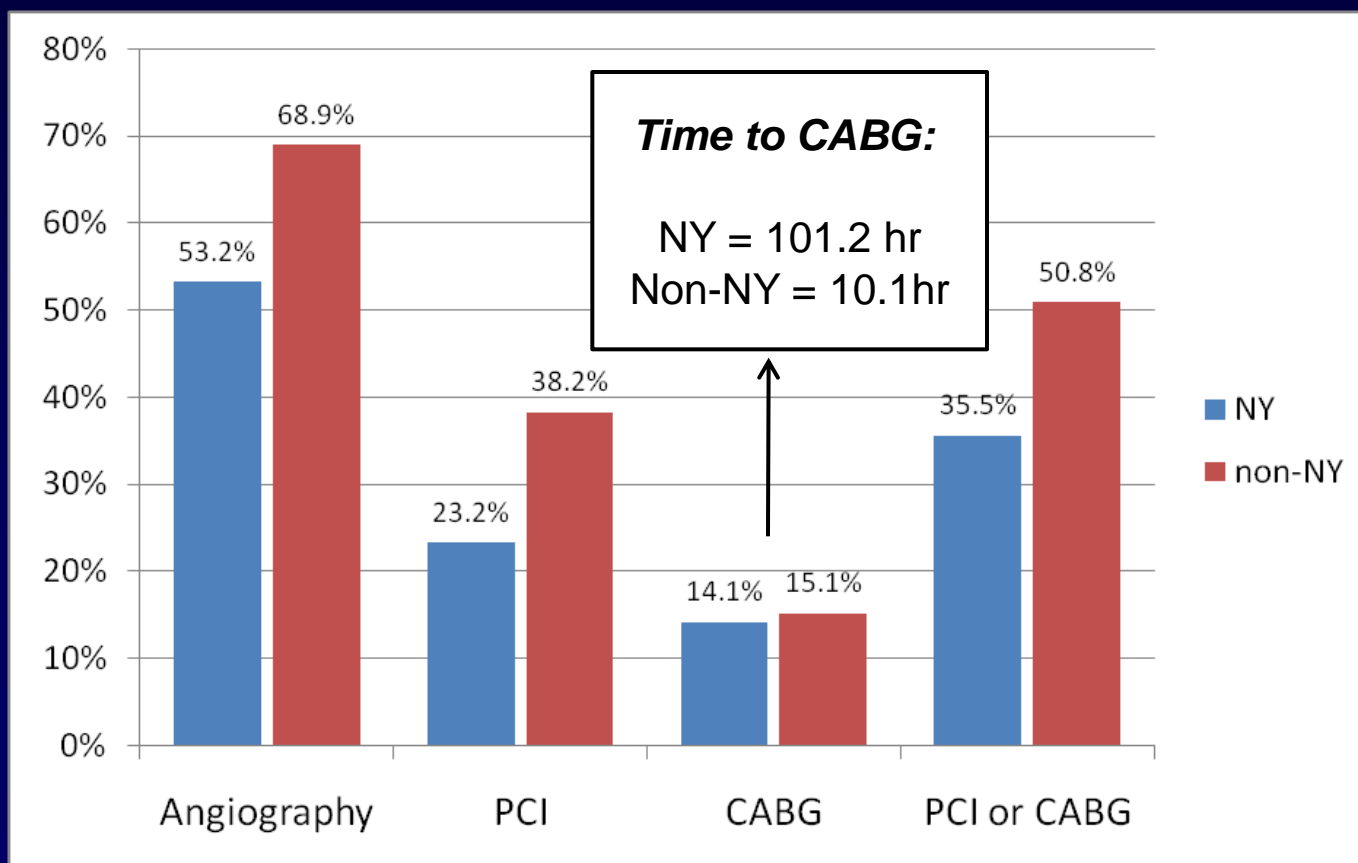
Comparison of 2003 revascularization rates for cardiogenic shock demonstrate a 2-fold difference between the States.





NY State in the SHOCK Trial

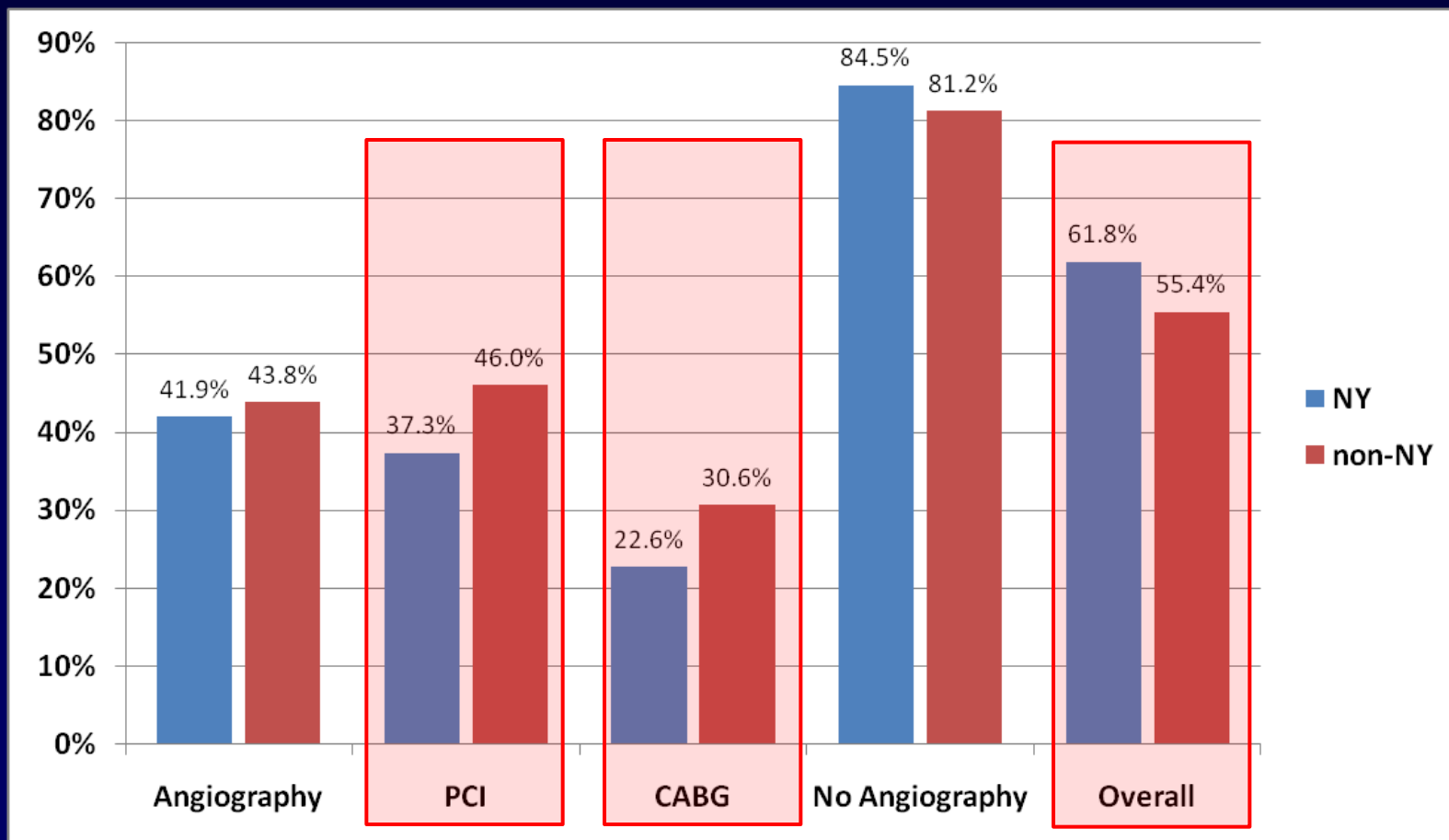
After institution of public reporting, centers in NY demonstrated lower rates of emergent revascularization as compared to non-NY centers.





NY State in the SHOCK Trial

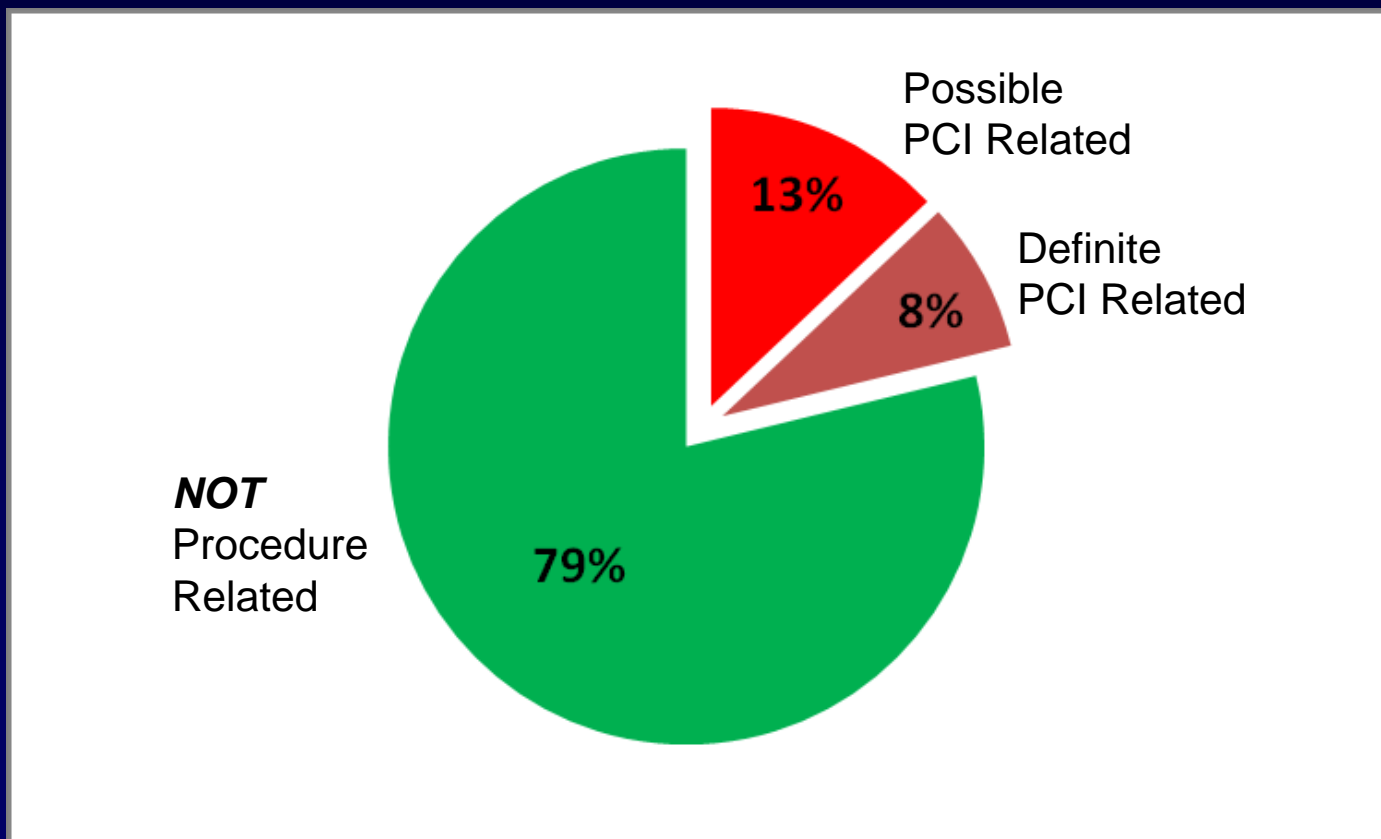
Selective utilization leads to decreased mortality for PCI and CABG in Shock patients....However, overall mortality is increased in NY as compared to other states.





Risk Adjustment Specificity

We reviewed over 5,000 consecutive PCI procedures at BWH to assess the adequacy of data collection systems and risk adjustment algorithms for predicting mortality post-PCI.



MA Public Reporting: So What?

CALENDAR
Size up their thoughts
Local fashion designers
show style and substance



SPORTS
Sox lose, 7-4, slip to second place
Undaunted Brady looks to next foe

VOLUME 268
NUMBER 84
50 cents
75 cents beyond
30 miles from Boston

The Boston Globe

THURSDAY, SEPTEMBER 22, 2005

INFALLIBLE
Today: Sunny and breezy.
High 94-89. Low 64-69.
Tomorrow: Showers, then clouds,
sun. High 78-83. Low 54-59.
High tide: 2:51 a.m. 3:05 p.m.
Full Report: Page D18

viewers and the passengers themselves, who saw events unfold on the satellite screens at their seats. **A2.**

Hospital halts heart surgeries due to deaths

DEATH RATES

Year	Deaths	Rate
'02	Bypass cases	3.9%
'03	Deaths	4.3%
'04	Deaths	4.1%
'05	Through August	3.8%

SOURCE: UMass Memorial Medical Center
AARON ATENCIO / THE BOSTON GLOBE

High rate cited at Worcester facility

By Liz Kowalczyk and Stephen Smith
GLOBE STAFF

UMass Memorial Medical Center abruptly stopped doing open heart surgeries this week because an unusually high percentage of cardiac patients have died after bypass operations since 2003.

Doctors at the hospital in Worcester have known for two years about problems in the heart surgery program, including, at one time, a high infection rate. But they did not alert patients or the public or suspend operations until after state public health officials presented them with a detailed analysis last week showing that the hospital's death rate for coronary artery bypass surgery patients was nearly twice the average for Massachusetts hospitals.

The hospital says that from 2003 through this August, 38 patients have died within a month of undergoing the surgery, out of 917 such operations.

UMass canceled about 10 surgeries scheduled for this week, following a telephone call last Friday during which the hospital and state health officials agreed that the program should be suspended. UMass

HEART, Page A8



TEXAS • Dallas
LA. Path of Hurricane Katrina
New Orleans
Houston
Galveston
Corpus Christi
8 p.m. Saturday
8 p.m. tomorrow
8 p.m. today
Projected path
Potential track
Oil refinery
Oil and natural gas platforms
Gulf of Mexico

SOURCE: ESRI, USGS

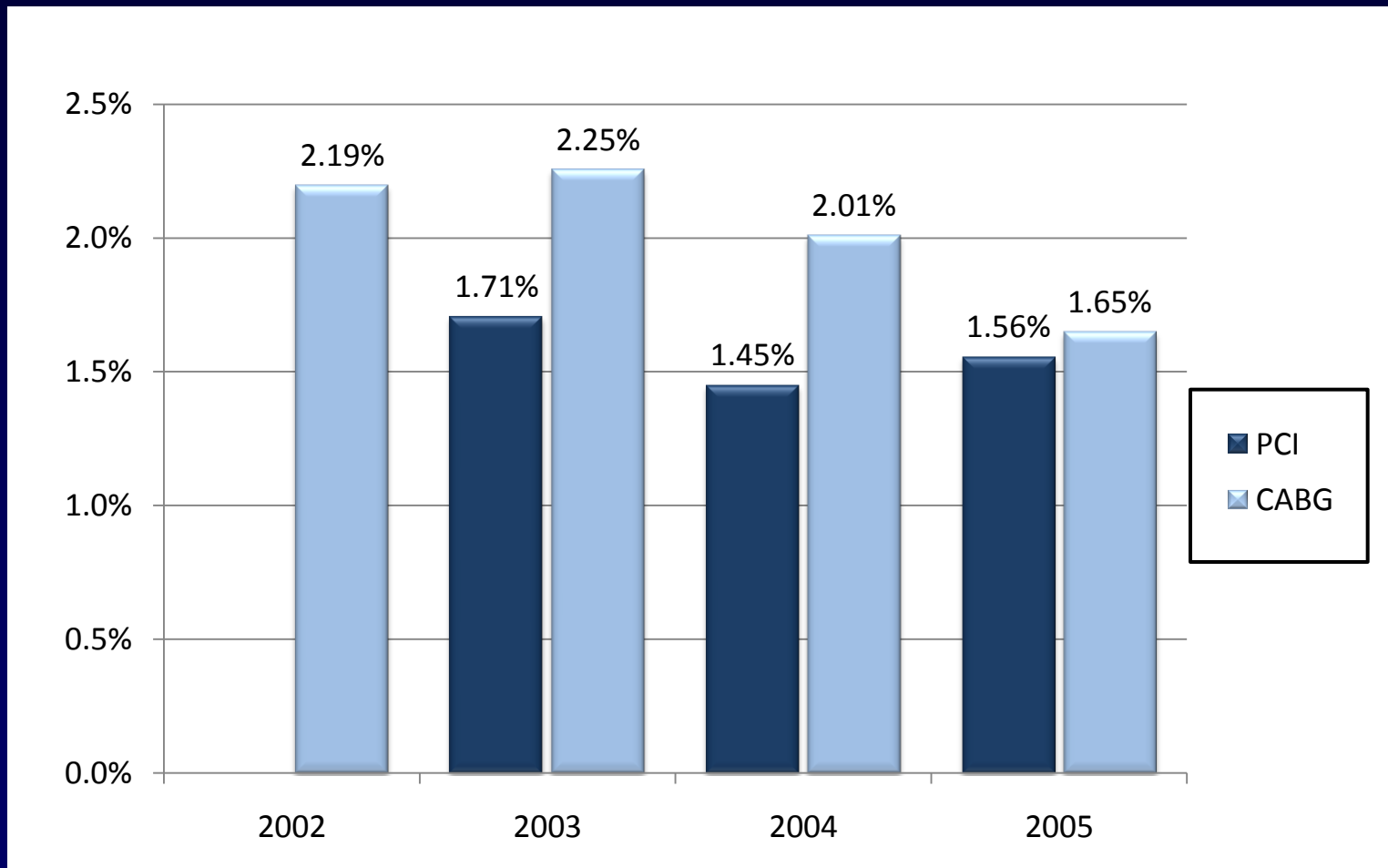
Levees, not storm surge

Poor design, inadequate construction, called the likely cause of the flooding of



Outcomes Trends in MA

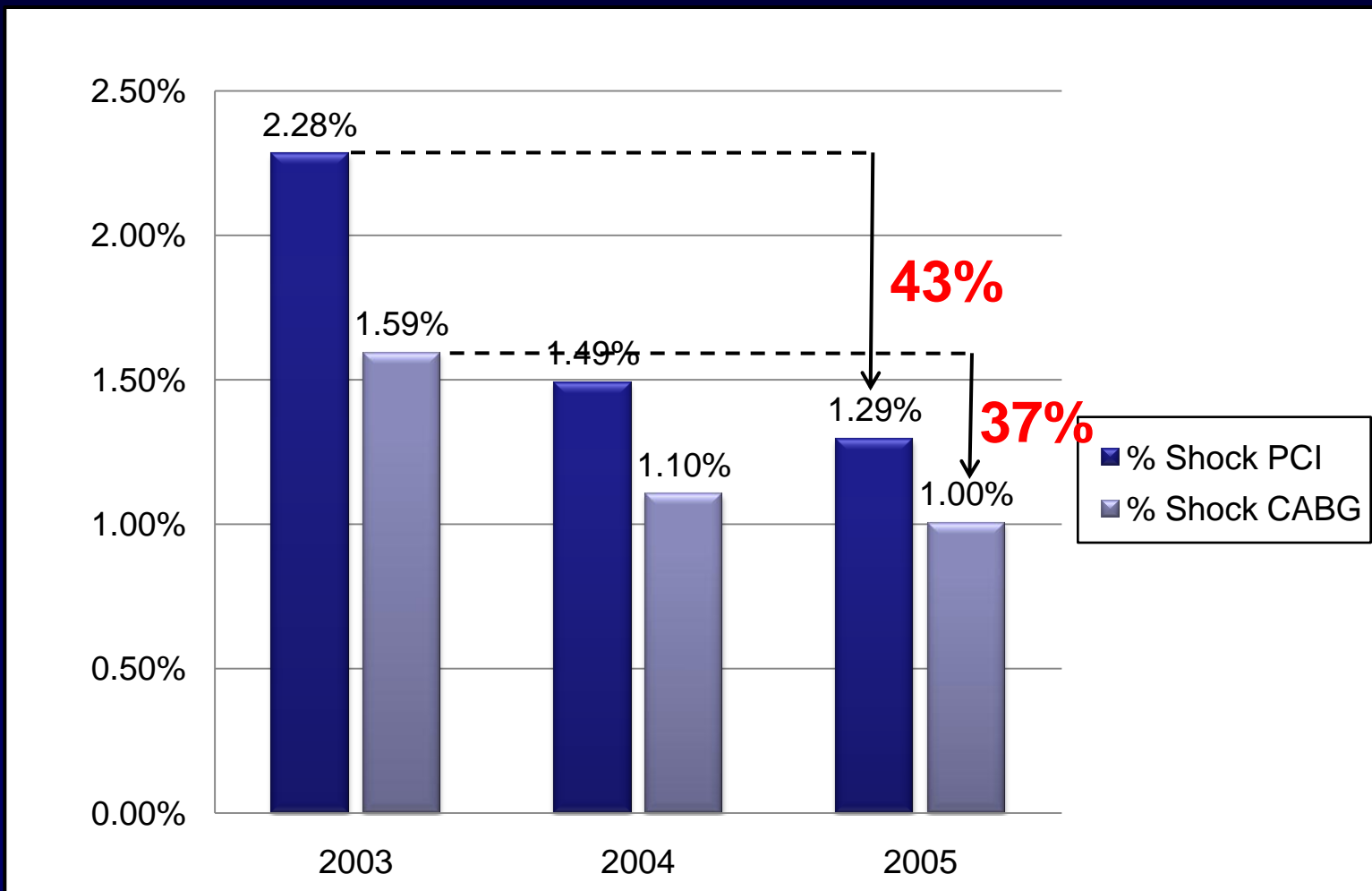
Unadjusted mortality has declined for both CABG and PCI treated patients in Massachusetts.





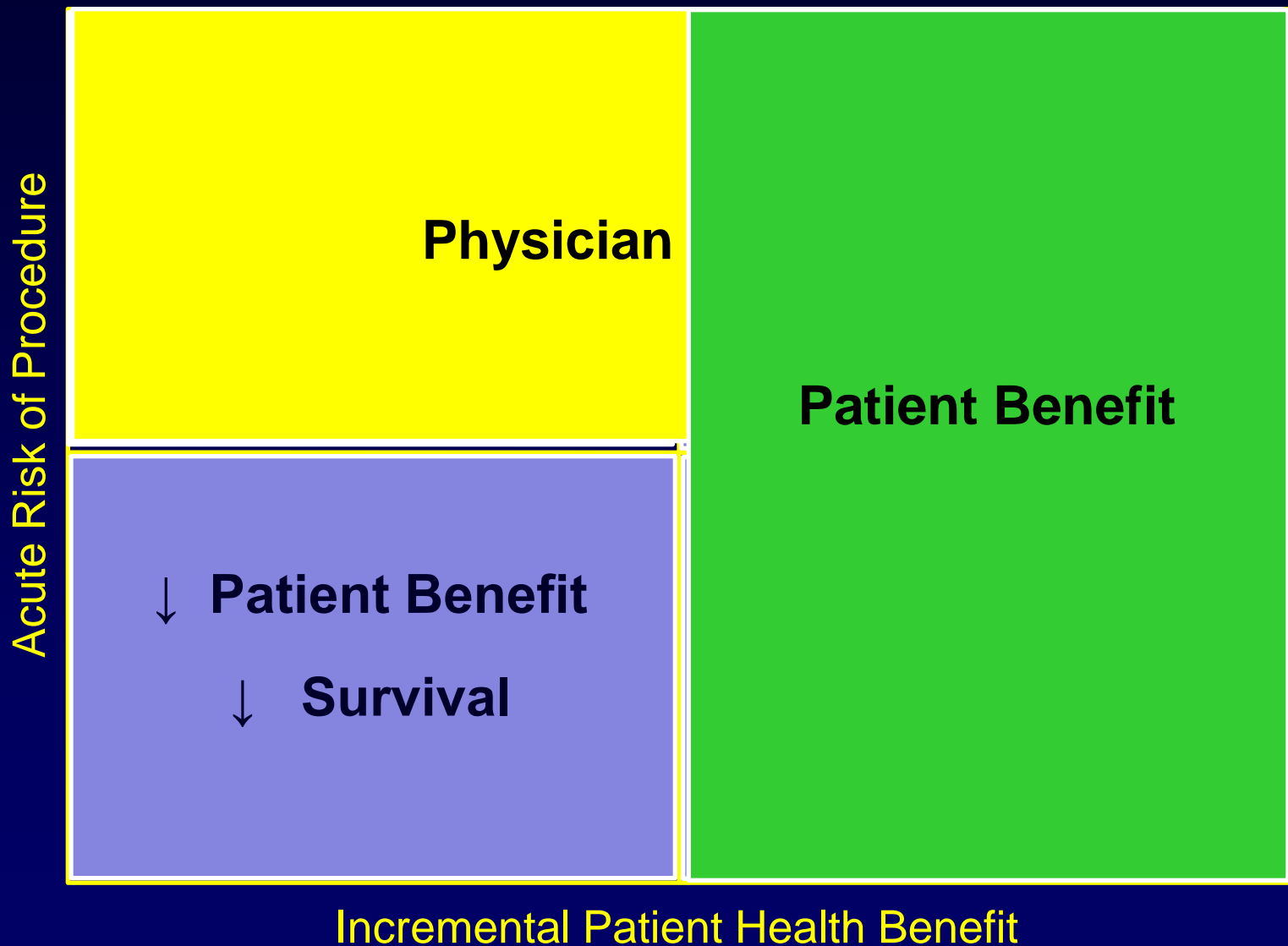
Decline of rate of revascularization in Cardiogenic Shock in Massachusetts

Between 2003 and 2005, the rates of revascularization in Massachusetts declined 37-43%



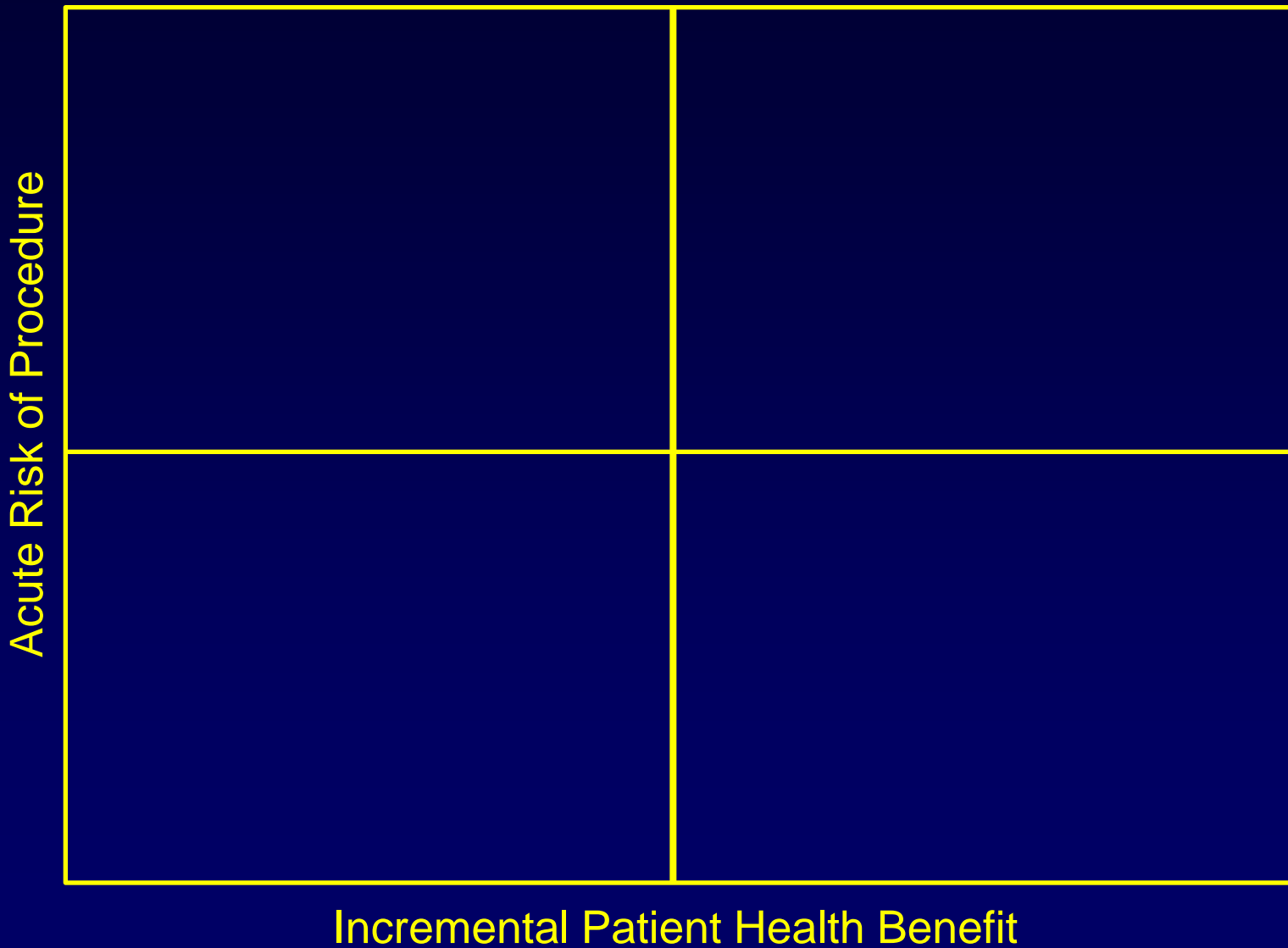


Appropriateness and Case Selection Creep



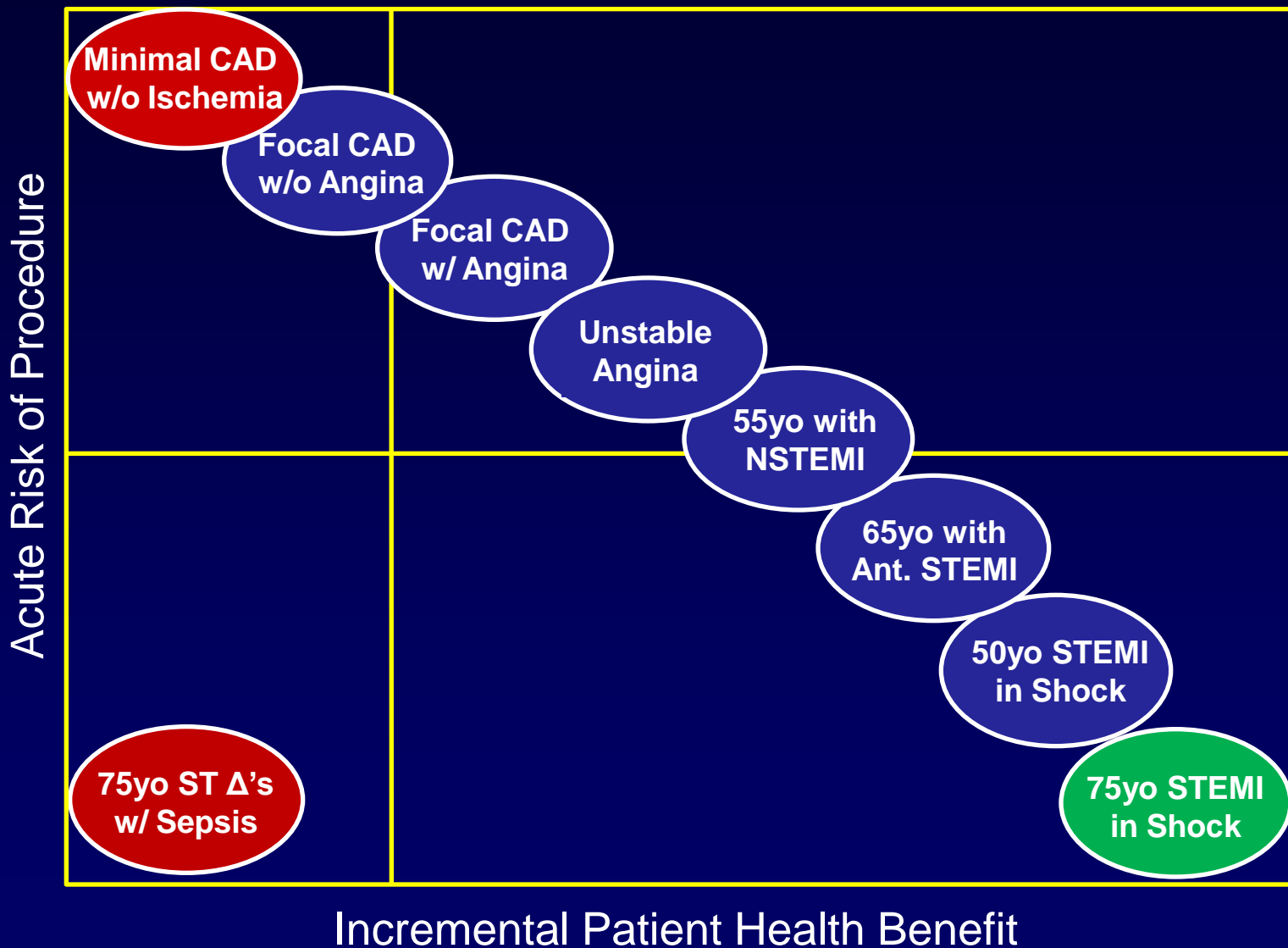


Appropriateness and Case Selection Creep



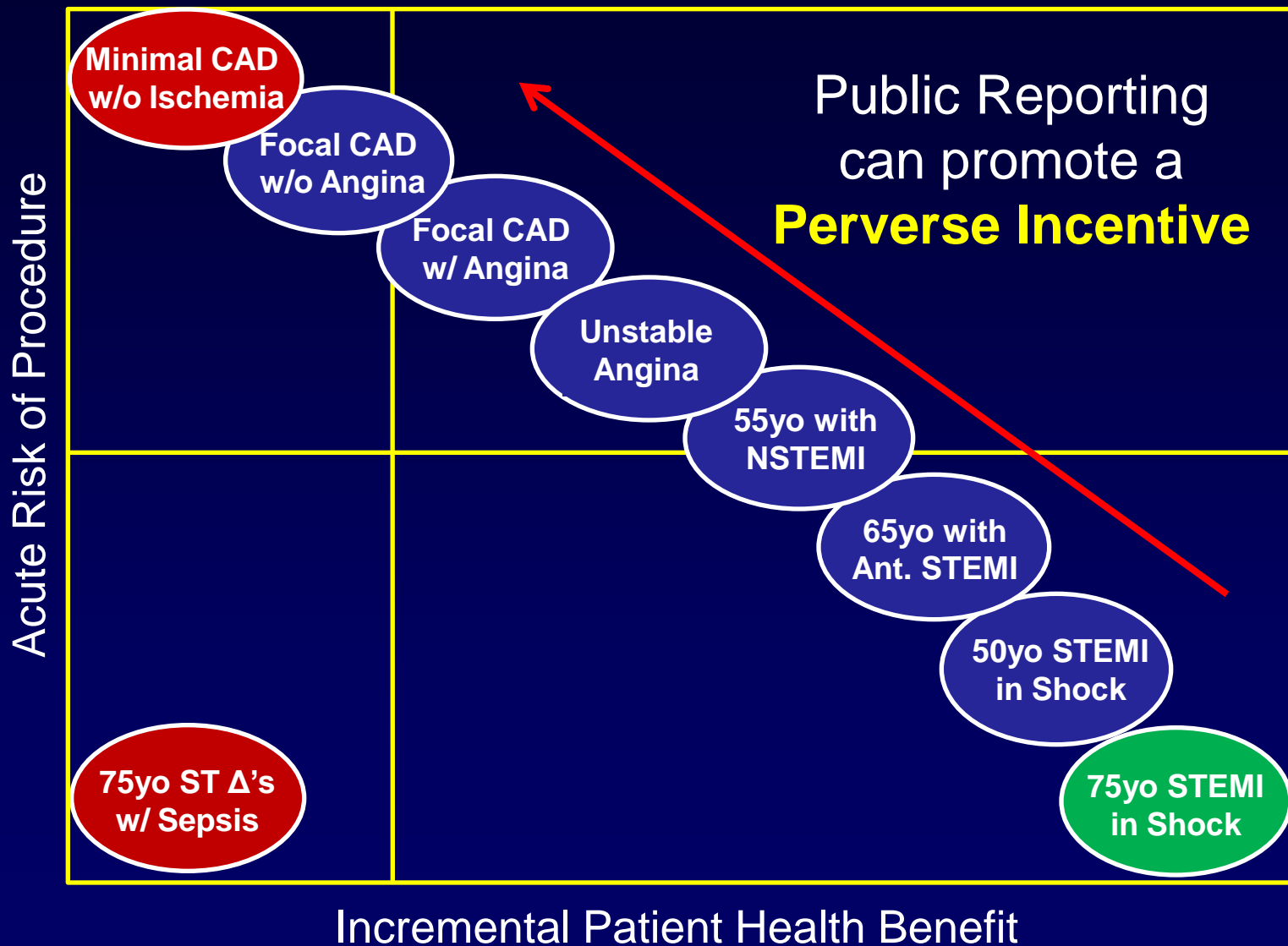


Appropriateness and Case Selection Creep



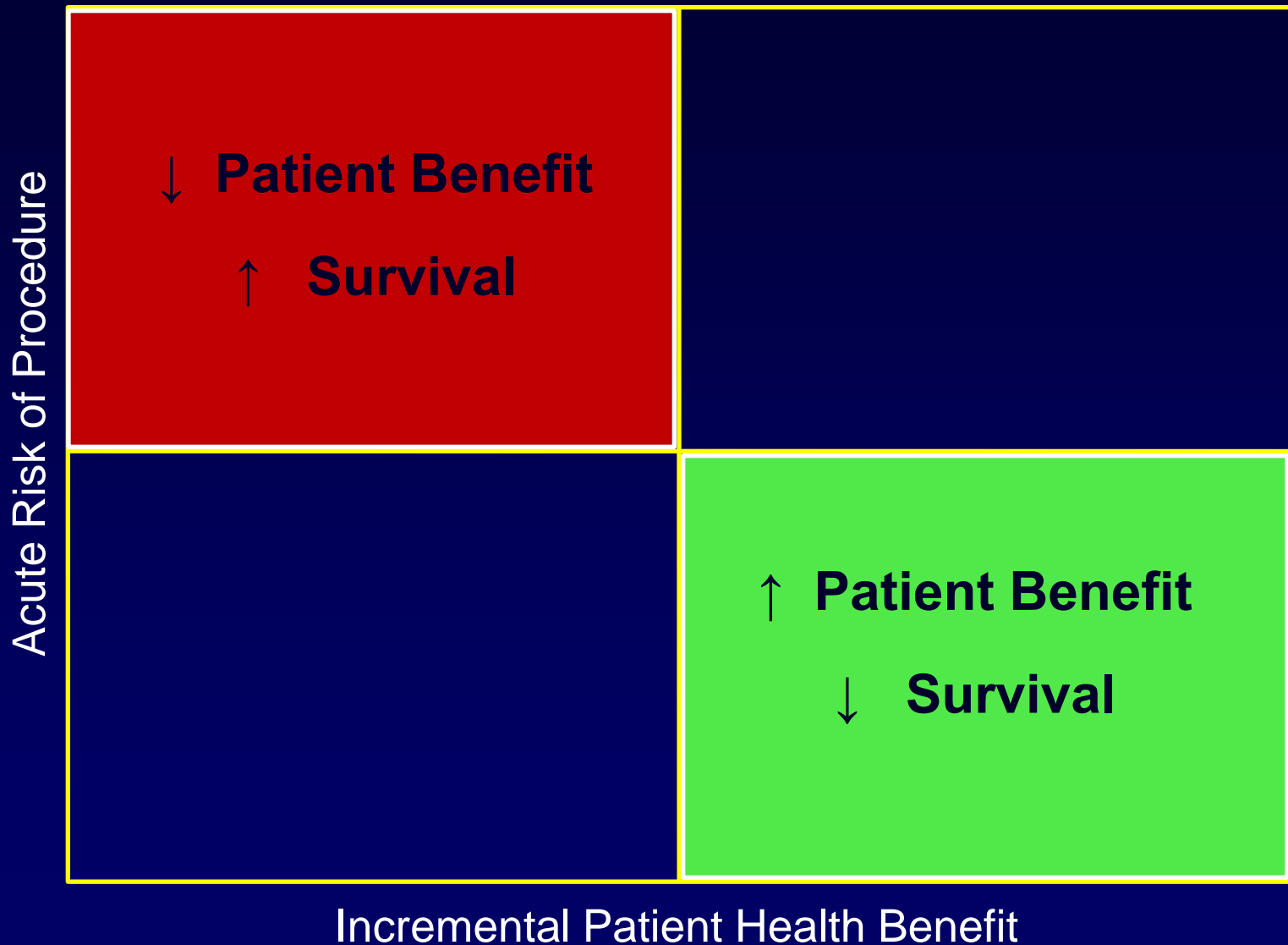


Appropriateness and Case Selection Creep





Appropriateness and Case Selection Creep



How to Reverse the Trend??

- Based on physician input, beginning in 2006, Mass-DAC began prospectively collecting compassionate use classification information for all PCI cases.
- Compassionate Use Prospectively Defined by any of:
 - Coma on presentation (Glasgow Coma score < 7)
 - Requirement for percutaneous assist support or percutaneous bypass (*since amended to high anatomic risk with or without ventricular support*)
 - CPR at start of procedure.
- 100% adjudication for all compassionate use cases by trained interventional cardiologists.
- Appeal process implemented to challenge adjudication decisions



Outcomes of CU Admissions

SOS Admissions, first PCI	Compassionate Use Only		SOS No CU		SOS Total		p-value
	N	Percent	N	Percent	N	Percent	
All Cases	96	100.0%	5492	100.0%	5588	100.0%	
Successful Procedure	76	79.2%	5176	94.2%	5252	94.0%	<0.001
Post-Procedure Cardiogenic Shock	6	6.3%	148	2.7%	154	2.8%	0.035
New Renal Failure	7	7.3%	68	1.2%	75	1.3%	<0.001
Any Bleeding Complication	14	14.6%	417	7.6%	431	7.7%	0.011
Bleeding - other/unknown source	8	8.3%	159	2.9%	167	3.0%	0.002
Any Vascular Complication	2	2.1%	48	0.9%	50	0.9%	0.212
Blood Products	25	26.0%	643	11.7%	668	12.0%	<0.001
In-Hospital Death	67	69.8%	245	4.5%	312	5.6%	<0.001
Primary Cause of Death							
Cardiac	46	47.9%	185	75.5%	231	4.1%	0.000
Neurologic	15	15.6%	12	4.9%	27	0.5%	<0.001
Death in Lab	13	13.5%	27	0.5%	40	0.7%	0.356



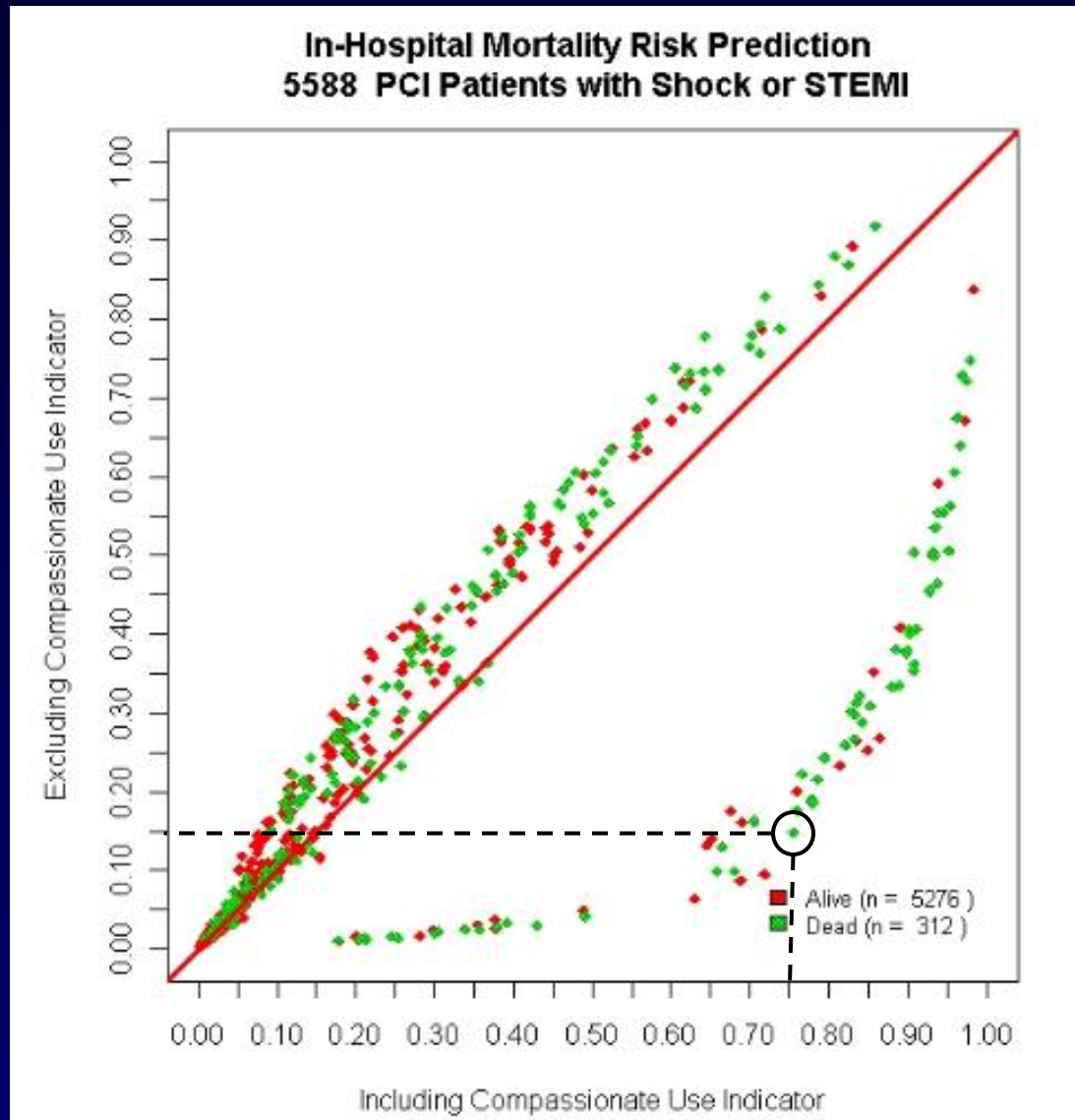
Improvement in Mortality Prediction Model (Shock/STEMI)

Table 4: Adjusted odds ratios of risk of in-hospital all-cause mortality following PCI in the Commonwealth of Massachusetts. Based on 5,588 PCI admissions from October 2005 through September 2007 and 312 deaths.

Risk Factor	Compassionate Use Excluded		Compassionate Use Included	
	Adjusted Odds Ratio	95% Posterior Interval	Adjusted Odds Ratio	95% Posterior Interval
AGE: 60 – 70 years	1.47	(0.97, 2.15)	1.66	(1.04, 2.50)
70-80 years	2.48	(1.68, 3.57)	2.94	(1.90, 4.30)
>80 years	5.37	(3.63, 7.65)	6.90	(4.49, 10.1)
Renal insufficiency	3.19	(2.10, 4.64)	3.11	(2.01, 4.58)
Ejection Fraction < 30%	1.74	(1.12, 2.57)	1.64	(1.02, 2.46)
Presence of LMCA lesion	1.94	(1.29, 2.83)	1.73	(1.09, 2.55)
Emergent or Salvage PCI	2.51	(1.23, 4.42)	2.06	(1.09, 3.69)
Cardiogenic Shock	14.0	(10.6, 18.4)	9.91	(7.07, 13.4)
Compassionate Use	Excluded		27.28	(14.5, 47.6)

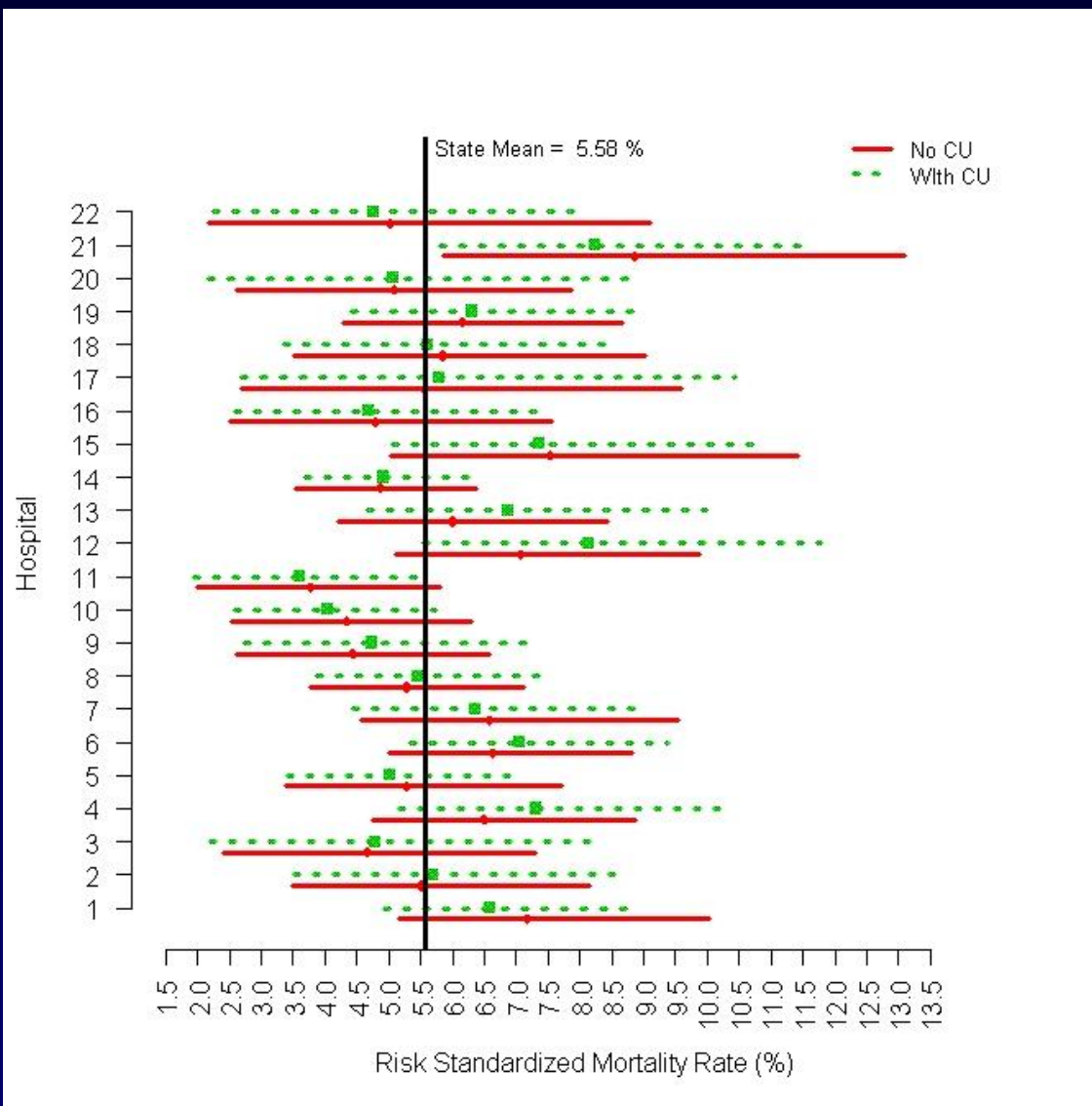


Reclassification of Cases with CU





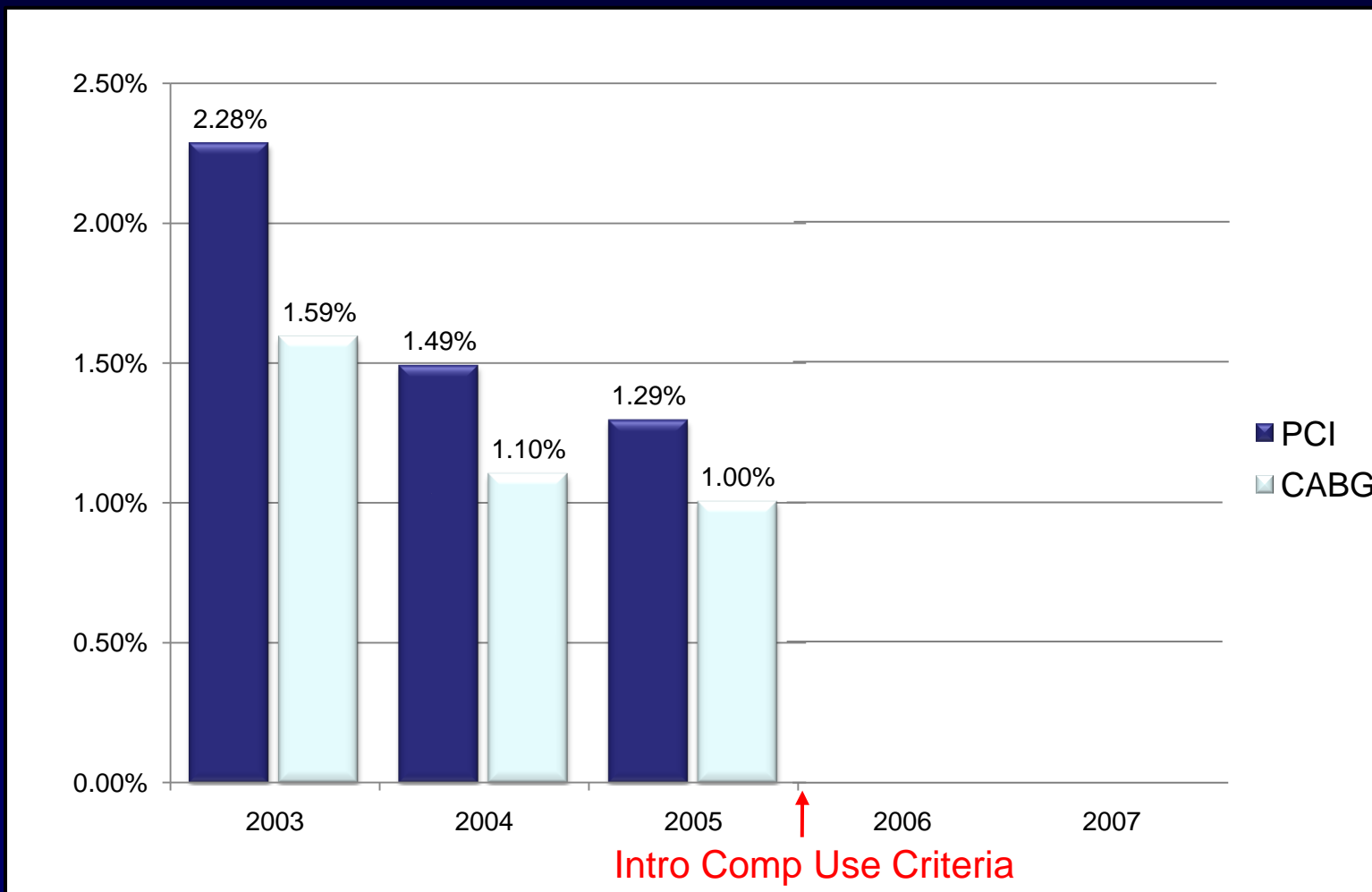
Impact on Center Performance





Decline of rate of revascularization in Cardiogenic Shock in Massachusetts

Between 2003 and 2005, the rates of revascularization in Massachusetts declined 37-43%.....



Value of Collaboration

- **The success of the MA Cardiac Quality project has been due, in large part, to:**
 - Reliance on high quality, granular clinical data
 - Hierarchical modeling approaches to address inter-institutional variability
 - Collaboration with clinical representatives
- **Collaboration with clinicians is bi-directional:**
 - Improves dissemination of best practices
 - Improves clinical acceptance of results
 - Improves models and statistical processes
 - Engages all parties for quality improvement



Further Refinement.....

- Based on MA-ACC Quality Oversight Committee recommendation, DPH and Mass-DAC have agreed to incorporate an additional covariate of “*Exceptional Risk*” to account for unmodeled covariates in current models.
- Extraordinary risk cases will include:
 - Cases meeting appropriateness criteria for PCI
 - Likelihood of benefit to patient
 - Coexisting condition not currently in model that would substantially increase risk of in-hospital death
 - 100% review and adjudication by multidisciplinary committee to include interventional cardiologist, clinical cardiologist, patient representative, DPH representative and medical ethicist.
- Culmination of 3 year effort by MA Chapter ACC.



Conclusions

- Monitoring the quality of cardiac procedures is essential, given the cost and consequences of these services.
 - Historical failure of physicians to adequately police the process
- MA has the most statistically rigorous methods to evaluate risk-adjusted mortality, and is viewed as a model by other states
- Rigorous review of high quality risk-adjusted mortality data is **necessary, but not sufficient**, to assess the quality of cardiac care delivered in Massachusetts.
- Beyond risk-adjusted mortality, quality must also account for **appropriateness** of care, **access** to care, additional health related outcomes of care, and evaluate key **processes** of care delivered

Thinking about Appropriateness

- **Measuring risk adjusted outcomes does not address appropriateness**
 - Most rigorous approach: Comprehensive case review with abstraction of appropriate use data for each case
 - Supplement with blinded sample review (including angiographic) of low AUC cases for every operator
 - Costly (in terms of time/energy) but highest reliability and validity
- **Hybrid approaches to consider:**
 - Screening using CathPCI AUC for low adherence
 - Sample low AUC cases for each operator below threshold
 - Angiographic review by independent MD group
 - Comprehensive review by external group for negative outliers



Brigham
and
Women's
Hospital

Comprehensive Cardiac Quality

Thank You!!

